A. AMENDMENTS TO SPECIFICATION

Please amend the application as indicated hereinafter:

Section 0002:

The data networks that are deployed by service providers or large enterprises often comprise hundreds or thousands of network devices. A network device may comprise ~~of one~~ one or more network elements, which are entities like modules, ports, slots etc. The network devices and their corresponding network elements may be managed by one or more network management systems, such as an operational support system (OSS), which are implemented using computer application programs that can communicate with the network devices. OSS applications are either obtained from commercially available sources or developed internally by telecommunications service providers.

Section 0016:

The foregoing needs, and other needs and objects that will become apparent ~~for the~~ from the following description, are achieved in the present invention, which comprises, in one aspect, a "generic" method of generating a label for use in correlating alarms emitted by network elements or system elements in a telecommunications network. The disclosed method is independent of the protocol used by a particular device vendor. An alarm message generated by a network element or system element of the telecommunications network is received. A context value in the alarm message is identified. A table that associates context values to internal correlation key value formulas is maintained. A unique external correlation key value or label is generated for the internal correlation key value. The alarm message and correlation key value are sent to an external system for use in correlating alarms.

Section 0018:

In another feature, the external system is an OSS ~~system~~ of a telecommunications service provider. The table may be stored at a gateway or proxy that is logically located in the telecommunication network between the network element or system element and an OSS ~~system~~ of a telecommunications service provider.

Section 0023:

In one specific approach, wherein each formula in the table specifies, for an associated context value, one or more ordinal positions of a plurality of fields ~~fields~~ in the alarm message, or a pattern to match, and one or more references to external database indexes or to programmatic procedures that are stored in an external database system, and wherein a concatenation of the fields and a result value from execution of the programmatic procedures yields the internal correlation key value. As another feature, the table is stored at a gateway that is logically located in the telecommunication network between the network element or system element and an OSS ~~system~~ of a telecommunications service provider; each formula in the table specifies, for an associated context value, one or more ordinal positions of fields in the alarm message and one or more references to objects in an external database system that is accessible to the gateway; and a concatenation of the fields and objects yields the internal correlation key value.

Section 0024:

Sending the alarm message and external correlation key value or label may involve sending an SNMP message to an OSS ~~system~~ that includes a complete SNMP object carrying the alarm message and the correlation key value. In another feature, an XML file is sent to an OSS ~~system~~ that includes the alarm message and the external correlation key value or label identified by unique XML tags.

Section 0027:

In this arrangement, benefits accrue in that the parsing module to extract correlation keys may be written once and thereby reduce the cost of the OSS ~~system~~. The potential for erroneous interpretation of alarms is reduced because the correlation keys and proxy servers may be tested and supported by the same party that creates, sells, services or maintains the corresponding network elements and system elements. The processing efficiency of the OSS in parsing unique error messages is greatly enhanced and simplified using relatively simple string comparison operations.

Section 0040:

In one embodiment, in a method for generating internal correlation key values for use in correlating alarms generated by network elements in a telecommunications network, an alarm message generated by a network element or system element of the telecommunications network is received. A context value in the alarm message is identified using a lookup table having an entry for each supported alarm. A table that associates context values to correlation key value formulas is maintained. A formula specifying how to generate the correlation key

value is retrieved from the table. A unique external correlation key value is created based on the formula. The alarm message and external correlation key value are sent to an external system, such as an OSS, for use in correlating alarms. The alarm message may be an SNMP message and the context value may be an SNMP context string. The table may be stored at a gateway that is logically located in the telecommunication network between the network element or system element and an OSS ~~system~~ of a telecommunications service provider. Each formula in the table may specify, for an associated context value, one or more ordinal positions of fields in the alarm message, or a pattern from which the fields are extracted, a concatenation of which yields the correlation key value. A formula may reference objects or programmatic procedures in an external database system. Because the internal keys may be large, the external keys are generated to uniquely represent the internal keys.

Section 0048:

FIG. 1B is a block diagram of an example network context in which an embodiment may be used. A managed ~~network 102~~ network 101 comprises at least one network element 120 that maintains a log file 103. Network element 120 may be one or more routers, switches, or other network devices. Network element 120 is communicatively coupled to other devices in network 102 and to a gateway 140 having a fault correlation proxy 130. The gateway 140 is further communicatively coupled, directly or indirectly through one or more intervening networks, to network management station 104. Network management station 104 executes an OSS 108 that includes a comparison module 150. Comparison module 150 carries out a string comparison, numeric comparison, bitwise comparison, or other comparison as appropriate to the data type of the keys and labels.

Section 0049:

For purposes of illustrating a simple example, FIG. 1B shows one network device 120. In a practical system, however, managed ~~network 102~~ network 101 may include any number of network devices, and may comprise one or more local area networks, wide area networks, metropolitan area networks, campus networks, or inter-networks.

Section 0054:

OSS 108 receives the alarm message. Comparison module 150 of OSS 108 examines the correlation key value in the alarm message and determines whether it matches a previously received alarm message. ~~If not, OSS 108 determines if the alarm message is relatively new. Thus i~~If no match occurs, then OSS 108 processes the received alarm. Such processing may include reporting the alarm to an end user through a graphical user interface, logging the received alarm in a log file of OSS 108, executing a pre-defined program to carry out specified steps, etc.

Section 0058:

Parsing module 132 may comprise one or more parsing processes that ~~carried~~ carry out required parsing using data from table 134. Each of the parsing processes is responsible for parsing a particular kind of alarm or event, or alarms or events from a particular kind of device. When an alarm is received, fault correlation proxy 130 selects one of the parsing processes based on information in the alarm. This arrangement enables fault correlation proxy 130 to process alarms having any format.

Section 0064:

In another embodiment, a value for a formula may be obtained by a database query or other query to an external system. In this embodiment, the formula in the intelligence table comprises a reference to a database object, or to an external function or process that provides a value for the correlation key. For example, an entry in the intelligence table may comprise the context string "ssngSyslogLinkStateChanged" and the formula "<1> + <2> + <13> + <cust_ID>." The values "<1>," "<2>," and "<13>" reference the first, second, and thirteenth ordinal positions of fields in the associated context string. The value <cust_ID> is the name of an object in a database system that is accessible to gateway 140. Thus, the formula indicates that the correlation key is generated by a string concatenation of the context string, the values "RouterA," "10.1.1.1," ~~"1/20,"~~ "2/1/30" and the value of a database variable named <cust_ID>, or a value returned by a database stored procedure named <cust_ID>. Alternatively, the value <cust_ID> references an external function or process that generates a customer identifier, such as a function of an API of the OSS, a function of a dynamic linked library, etc. This approach enables gateway 140 to introduce a customer-specific or otherwise unique element into the correlation key value.

In Section 0074:

Network element layer 208 represents the logical position of network devices in a network. Network element layer 208 may comprise, for example, one or more access devices acting as media gateways 120C; one or more edge devices acting as media gateways 120D;

one or more core devices 226, which do not act as MGs; and one or more media gateway controllers 112C.

In the Abstract:

A method for generating compressed correlation key values for use in correlating alarms generated by network elements in a telecommunications network is disclosed. An alarm message generated by a network element is received. A context value in the alarm message is identified. A table that associates context values to correlation key value formulas is maintained. A formula specifying how to generate the correlation key value is retrieved from the table. Each formula may specify, for an associated context value, one or more ordinal positions of fields in the alarm message, a concatenation of which yields the correlation key value. The correlation key value is created based on the formula. A unique ordinal number is generated to represent the correlation key value, which acts as a context key. ~~The ordinal number and the context key pair are stored in external persistent storage for later retrieval in case of restart.~~ The alarm message and correlation key value are sent to an external system for use in correlating alarms. ~~The alarm message may be an SNMP message and the context value may be an SNMP context string. The table may be stored at a gateway in the telecommunication network between the network element and an OSS system. Each formula may specify, for an associated context value, one or more ordinal positions of fields in the alarm message, a concatenation of which yields the correlation key value. A formula also may reference objects or programmatic procedures in an external database system. Use of an internal correlation key and external correlation key in this manner greatly reduces the~~

~~overhead involved in adding correlation keys to the original message; for example, a 32-bit numeric value can serve as a correlation key for a 100-character alarm message.~~